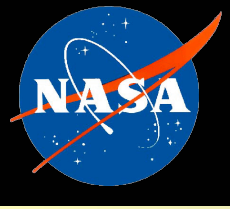

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V6 Planning … ~~take 1~~ ~~take 2~~ ~~take 3~~ take 4

Revisiting our Approach, Schedule, Process and Goals

Steven Friedman
AIRS Science Processing

October 17, 2008

This work was carried out at the Jet Propulsion Laboratory, California Institute of Technology under a contract with the National Aeronautics and Space Administration.

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Version 6 Priorities

- **Level 1B Priorities**
  - Improve Spectral Calibration
  - Maintain Channel Properties
  - Improve Dynamic Noise Estimates
- **Level 1C Climate Product (New)**
  - Remove Artifacts from L1B
- **Operations Priorities**
  - Instrument Maintenance and Calibration
  - Trending Performance and Icing

From 10/07 SciTeam Meeting

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Version 6 Priorities

- **Level 2**
  - Bias Trend Removal
  - Improve Boundary Layer Sensitivity
  - Retrieve Surface Emissivity
  - Yield Improvement in Critical Areas
  - Improve Error Estimation
  - RTA Improvement
  - Improve OLR computation
  - Cloud Retrieval Improvement
  - Retrieve Mid Tropospheric CO2
- **Level 3**
  - Reduce Sampling Bias Effects

From 10/07 SciTeam Meeting

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Science Team Participation Critical to Version 6 Objectives

- **Susskind (GSFC)**
  - Surface Parameters (T, e)
  - Boundary Layer T, q
  - Trend Evaluations/ Recommendations
  - Improved Error Estimates and QC
  - Cloud/Dust Product Improvement
  - 1 x 3 Retrievals
- **Strow (UMBC)**
  - L1C Algorithm
  - RTA Scattering Algorithm
  - Additional RTA Tasks
    - Dust
    - Cirrus
  - OLR
- **Blackwell (MIT)**
  - SCC/NN Investigation
- **Barnet (NOAA)**
  - Bias Trends Removal
  - Cloud Clearing vs Warmest FOV
  - CO2
  - SO2 , CH4, HNO3, N2O,O3
  - CAPE, LI + Convective Products
  - 1x3 (NOAA Interest, SPORT, Forecasters, etc.)
- **Goldberg (NOAA)**
  - Initialization State (Regression Coefficients)
  - Maintain RT System
- **Rosenkranz (MIT)**
  - Updated MW RTA
- **JPL**
  - CO2 (Chahine)
  - Cirrus (B. Kahn)
  - L1C (H. Aumann)

From 10/07 SciTeam Meeting

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V6 Development History

- **Concept Development (October 2007 – April 2008)**
  - First concept discussions at September 2006 Science Team MTG
  - Key features Identified at October 2007 Science Team MTG
- **Research and algorithm development (January 2008 – August 2008)**
  - Several Net-Meetings conducted
  - Status reviewed at every Science Team MTG since V6 inception
  - Testing – six months allocated for comprehensive tests
  - Allotted time – greater than 1 year
  - Yet, we have made little progress in some priority research topics
  - *But, it has not been for lack of trying*

Version 6 Priorities
Level 1B

- **Improve Spectral Calibration**
  - Add modeled spectral shift
  - Work nearly complete, reported at this Science Team
- **Maintain Channel Properties**
  - Designed but not coded
- **Improve Dynamic Noise Estimates**
  - Have not arrived at any significant improvements over current approach

Version 6 Priorities

Level 1C Climate Product

- **Create new L1C product by removing artifacts from L1B**
  - Algorithms defined for the following:
    - Clean-up of Outliers (needs validation)
    - Gap filling (needs validation)
    - Radiance resampling to a fixed frequency grid
  - Have not determined output format/process

- **Bias Trend Removal – discussion still, some ideas, we have a plan.**
  - This critical issue is still open
  - Three components contribute to the bias trend, two are understood:
    - CO2
    - Cloud-cleared regression contributes in lower trop.
    - N20
  - No solution worked out yet
  - Most recently discussed at this Science Team MTG and will be discussed again today

Version 6 Priorities

Level 2 (cont'd)

- **Improve Boundary Layer Sensitivity**
  - Added new cloud-clearing channels, provided some improvement (no metric)
- **Retrieve Surface Emissivity – done at GSFC, needs to be integrated**
  - Work completed, will be presented at this session
- **Yield Improvement in Critical Areas (polar, proximity to storms, above clouds)**
  - Some improvement, esp. over deserts
  - Code needs to be integrated at JPL

Version 6 Priorities Level 2 (cont'd)

- **Improve Error Estimation**
  - No improvement to date
  - Issue remains open
- **RTA Improvement**
  - Algorithmic work completed, and improves CO2 and trace gases. This work has not incorporated into anyone's code (GSFC, NOAA or JPL) – *this is an issue!*
  - Dust currently not implemented, but can be incorporated
  - Dust and Frequency Correction are out of scope right now

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Version 6 Priorities Level 2 (cont'd)

- **Improve OLR computation**
  - In process at GSFC, using AER code
- **Add Cloud and Dust Retrievals**
  - Identified spurious cases that can be resolved, but not coded yet. Still refining work at GSFC
  - No other work cloud retrieval work planned
  - No dust retrieval planned

- **Retrieve Mid Tropospheric CO2**
  - CO2 product produced via VPD method as post L2 PGE process
  - Will also incorporate NOAA CO2 into mainline code – but must evaluate quality and effect of including in PGE. *Also, no knowledge of how NOAA code in main-line retrieval would affect VPD post-retrieval CO2 retrieval.*

- **Mitigate potential loss of AMSU Channel 5**
  - Improve IR-Only Retrieval
  - Determine if we can continue using AMSU data without Channels 4 and 5 while bringing Channel 7 back into use
  - This is new priority item, as trend analysis indicates that AMSU Channel 5 will fail within six-months to 1 year
  - Work has not begin

- **Reduce Sampling Bias Effects**
  - Concept still under development
  - This is not as time-critical as L2 work

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Version 6 Report Card

- **Level 1B Priorities**
  - Improve Spectral Calibration — Nearly Complete
  - Maintain Channel Properties — Designed, Not coded
  - Allow Dynamic Noise Estimates — No significant improvement
- **Level 1C Climate Product (New)**
  - Remove Artifacts from L1B — In process

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V6: Development Report Card (cont'd)

Level 2	
Bias Trend Removal	Not resolved
Improve Boundary Layer Sensitivity	Partially completed
Retrieve Surface Emissivity	Completed
Yield Improvement in Critical Areas	Completed
Improve Error Estimation	Not worked yet
RTA Improvement	Only minor improvements
Improve OLR computation	Some work completed
Cloud Retrieval Improvement	Not worked yet
Retrieve Mid Tropospheric CO2	VPD done NOAA version not
Mitigate AMSU Channel 5 Failure	Not worked yet
Level 3	
Reduce Sampling Bias Effects	Not worked yet

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V6: Development Report Card Assessment

- **Key priority items for V6 still need to be worked**
  - Bias Trend
  - Mitigate potential effects of failure of AMSU Channel 5
  - Other key items (depending on your interest area)
- **V6 Was supposed to enter final integration and test stages in August**
- **We did not get there**
- ***Work must continue, we need to re-plan!***

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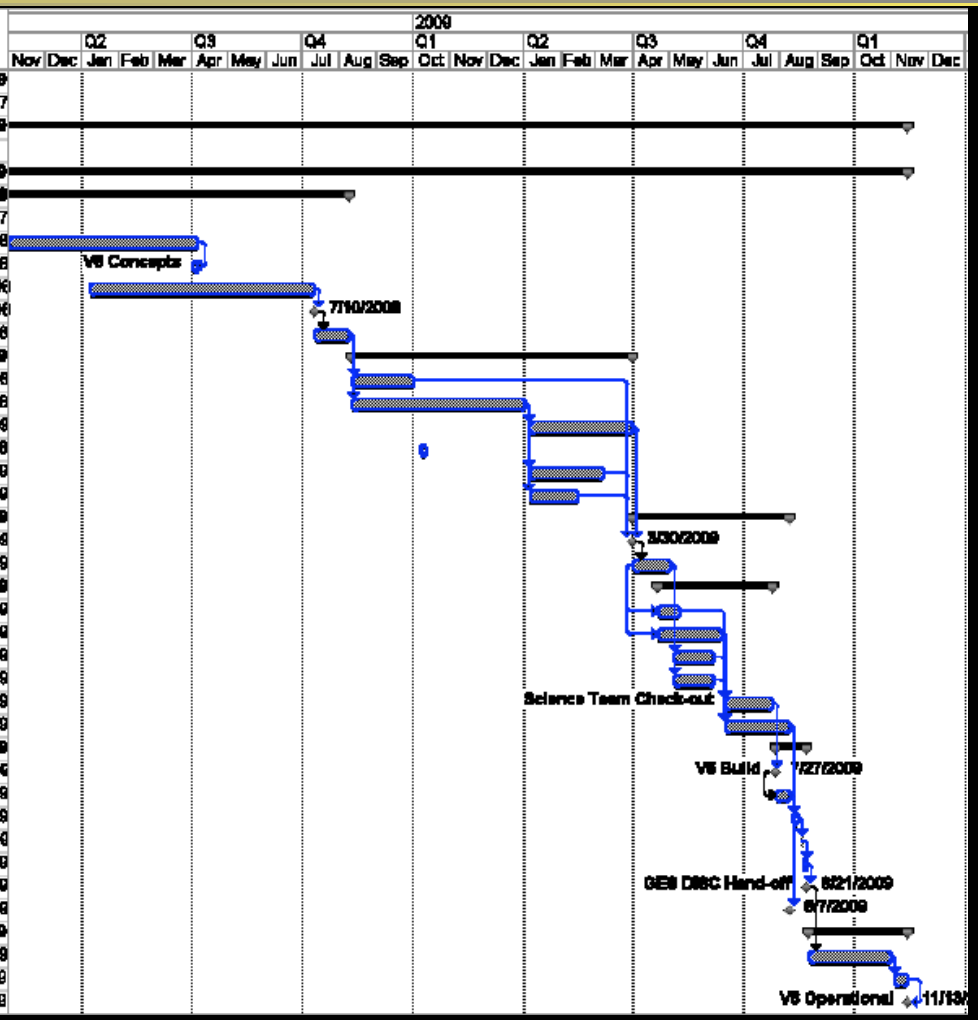
Historical Version V6 Schedule
April and September 2007 Science Team MTGs

ID	Task Name	Start	Finish
1	AIRS Software Upgrades Operational	Wed 7/25/07	7/25/2007
2	V5	Wed 7/25/07	7/25/2007
3	V6	Tue 10/9/07	Fri 11/13/09
4			
5	V6 End-to-End	Tue 10/9/07	Fri 11/13/09
6	V6 Concept and Prototype Developm	Tue 10/9/07	Fri 6/6/08
7	V6 Kickoff - Science Team Meeting	Tue 10/9/07	Fri 10/12/07
8	V6 Concept Development and Prototy	Mon 10/15/07	Fri 4/4/08
9	Science Team Meeting - V6 Concept	Tue 4/1/08	Fri 4/4/08
10	V6 Algorithm Development	Mon 1/7/08	Thu 7/10/08
11	Net Meeting - Algorithm Wrap-up	Thu 7/10/08	Thu 7/10/08
12	Issue Reconciliation	Fri 7/11/08	Fri 6/6/08
13	V6 Product Integration (JPL)	Mon 6/11/08	Mon 3/30/09
14	Level 1 PGEs	Mon 6/11/08	Tue 9/30/08
15	Level 2 PGEs	Mon 6/11/08	Wed 12/31/08
16	Iterative step-through L2 PGE	Mon 1/5/09	Mon 3/30/09
17	Science Team Meeting (Integration S	Tue 10/7/08	Fri 10/10/08
18	Level 3 PGEs	Mon 1/5/09	Fri 3/6/09
19	Match-Up and Cal Subset	Mon 1/5/09	Fri 2/13/09
20	V6 Testing	Mon 3/30/09	Fri 8/7/09
21	V6 Candidate Build	Mon 3/30/09	Mon 3/30/09
22	Generation of Test Products	Tue 3/31/09	Fri 5/1/09
23	PGE Testing	Tue 4/21/09	Fri 7/24/09
24	Level 1	Tue 4/21/09	Fri 5/8/09
25	Level 2	Tue 4/21/09	Fri 8/12/09
26	Level 3	Mon 5/4/09	Fri 6/5/09
27	Match-Up and Cal Subset	Mon 5/4/09	Fri 6/5/09
28	Science Team Check-out	Mon 6/15/09	Fri 7/24/09
29	Documentation - all testing	Mon 6/15/09	Fri 6/7/09
30	Package and Deliver	Mon 7/27/09	Fri 8/21/09
31	V6 Delivery Build	Mon 7/27/09	Mon 7/27/09
32	Final Checkout	Tue 7/28/09	Fri 6/7/09
33	V6 Packaging	Mon 8/10/09	Fri 8/14/09
34	V6 Code Delivery	Mon 8/17/09	Tue 8/18/09
35	JPL Unpack and Checkout	Wed 8/19/09	Fri 8/21/09
36	Hand-off to GES DISC	Fri 8/21/09	Fri 8/21/09
37	Deliver Documentation	Fri 8/7/09	Fri 8/7/09
38	GES DISC I&T	Mon 8/24/09	Fri 11/13/09
39	V6 Integration and Test (GES DISC)	Mon 8/24/09	Fri 10/30/09
40	V6 End-toEnd Flow Testing	Mon 11/2/09	Fri 11/13/09
41	V6 Data Processing Begins	Fri 11/13/09	Fri 11/13/09



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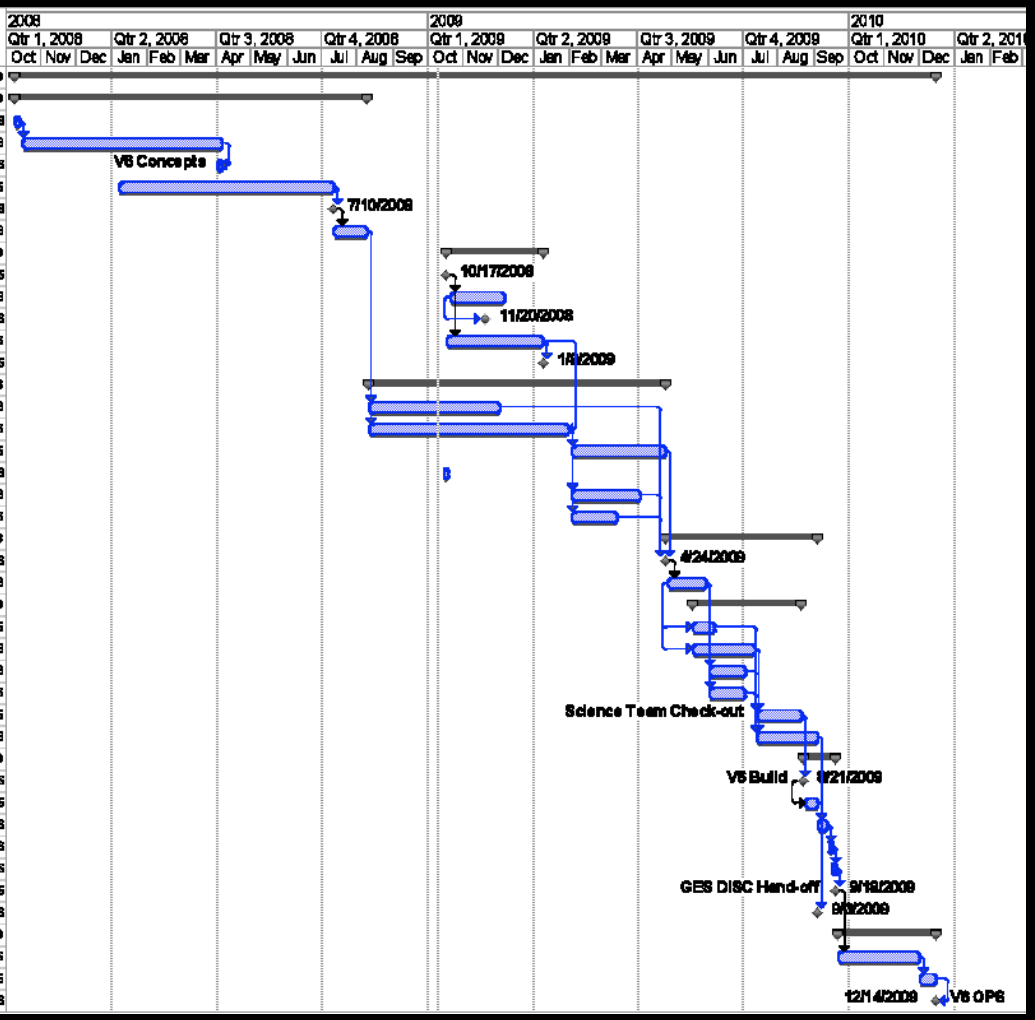
New V6 Schedule
October 2008 Science Team Meeting

ID	Task Name	Start	Finish	Duration
5	**V6 End-to-End**	**Tue 10/9/07**	**Mon 12/14/09**	**546 days**
6	**V6 Concept and Prototype Development**	**Tue 10/9/07**	**Fri 8/8/08**	**209 days**
7	V6 Kickoff - Science Team Meeting	Tue 10/9/07	Fri 10/12/07	4 days
8	V6 Concept Development and Prototypir	Mon 10/15/07	Fri 4/4/08	117 days
9	Science Team Meeting - V6 Concepts	Tue 4/1/08	Fri 4/4/08	4 days
10	V6 Algorithm Development	Mon 1/7/08	Thu 7/10/08	130 days
11	Net Meeting - Algorithm Wrap-up	Thu 7/10/08	Thu 7/10/08	0 days
12	Issue Reconciliation	Fri 7/11/08	Fri 8/8/08	21 days
13	**V6 Key Concept Follow-on**	**Fri 10/17/08**	**Thu 1/8/09**	**54 days**
14	Science Team Buy-In	Fri 10/17/08	Fri 10/17/08	0 days
15	Research Issues	Mon 10/20/08	Fri 12/5/08	33 days
16	Net Meeting	Thu 11/20/08	Thu 11/20/08	0 days
17	Algorithm Development	Fri 10/17/08	Wed 1/7/09	53 days
18	Net Meeting	Thu 1/8/09	Thu 1/8/09	0 days
19	**V6 Product Integration (JPL)**	**Mon 8/11/08**	**Fri 4/24/09**	**176 days**
20	Level 1 PGEs	Mon 8/11/08	Mon 12/1/08	78 days
21	Level 2 PGEs	Mon 8/11/08	Fri 1/30/09	117 days
22	Iterative step-through L2 PGE	Mon 2/2/09	Fri 4/24/09	59 days
23	Science Team Meeting (Integration Statu	Tue 10/14/08	Fri 10/17/08	4 days
24	Level 3 PGEs	Mon 2/2/09	Thu 4/2/09	43 days
25	Match-Up and Cal Subset	Mon 2/2/09	Fri 3/13/09	29 days
26	**V6 Testing**	**Fri 4/24/09**	**Thu 9/3/09**	**92 days**
27	V6 Candidate Build	Fri 4/24/09	Fri 4/24/09	0 days
28	Generation of Test Products	Mon 4/27/09	Fri 5/29/09	24 days
29	**PGE Testing**	**Mon 5/18/09**	**Thu 8/20/09**	**67 days**
30	Level 1	Mon 5/18/09	Fri 6/5/09	14 days
31	Level 2	Mon 5/18/09	Fri 7/10/09	38 days
32	Level 3	Mon 6/1/09	Thu 7/2/09	24 days
33	Match-Up and Cal Subset	Mon 6/1/09	Thu 7/2/09	24 days
34	Science Team Check-out	Mon 7/13/09	Thu 8/20/09	29 days
35	Documentation - all testing	Mon 7/13/09	Thu 9/3/09	39 days
36	**Package and Deliver**	**Fri 8/21/09**	**Fri 9/18/09**	**19 days**
37	V6 Delivery Build	Fri 8/21/09	Fri 8/21/09	0 days
38	Final Checkout	Mon 8/24/09	Thu 9/3/09	9 days
39	V6 Packaging	Fri 9/4/09	Fri 9/11/09	5 days
40	V6 Code Delivery	Mon 9/14/09	Tue 9/15/09	2 days
41	JPL Unpack and Checkout	Wed 9/16/09	Fri 9/18/09	3 days
42	Hand-off to GES DISC	Fri 9/18/09	Fri 9/18/09	0 days
43	Deliver Documentation	Thu 9/3/09	Thu 9/3/09	0 days
44	**GES DISC I&T**	**Mon 9/21/09**	**Mon 12/14/09**	**59 days**
45	V6 Integration and Test (GES DISC)	Mon 9/21/09	Mon 11/30/09	49 days
46	V6 End-toEnd Flow Testing	Tue 12/1/09	Mon 12/14/09	10 days
47	V6 Data Processing Begins	Mon 12/14/09	Mon 12/14/09	0 days



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New V6 Schedule Near-Term Items

ID	Task Name	Start	Finish	Duration
5	**V6 End-to-End**	**Tue 10/9/07**	**Mon 12/14/09**	**546 days**
6	**V6 Concept and Prototype Development**	**Tue 10/9/07**	**Fri 8/8/08**	**209 days**
7	V6 Kickoff - Science Team Meeting	Tue 10/9/07	Fri 10/12/07	4 days
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10	V6 Algorithm Development	Mon 1/7/08	Thu 7/10/08	130 days
11	Net Meeting - Algorithm Wrap-up	Thu 7/10/08	Thu 7/10/08	0 days
12	Issue Reconciliation	Fri 7/11/08	Fri 8/8/08	21 days
13	**V6 Key Concept Follow-on Research**	**Fri 10/17/08**	**Thu 1/8/09**	**64 days**
14	Science Team Buy-In	Fri 10/17/08	Fri 10/17/08	0 days
15	Research Issues	Mon 10/20/08	Fri 12/5/08	33 days
16	Net Meeting	Thu 11/20/08	Thu 11/20/08	0 days
17	Algorithm Development	Fri 10/17/08	Wed 1/7/09	53 days
18	Net Meeting	Thu 1/8/09	Thu 1/8/09	0 days
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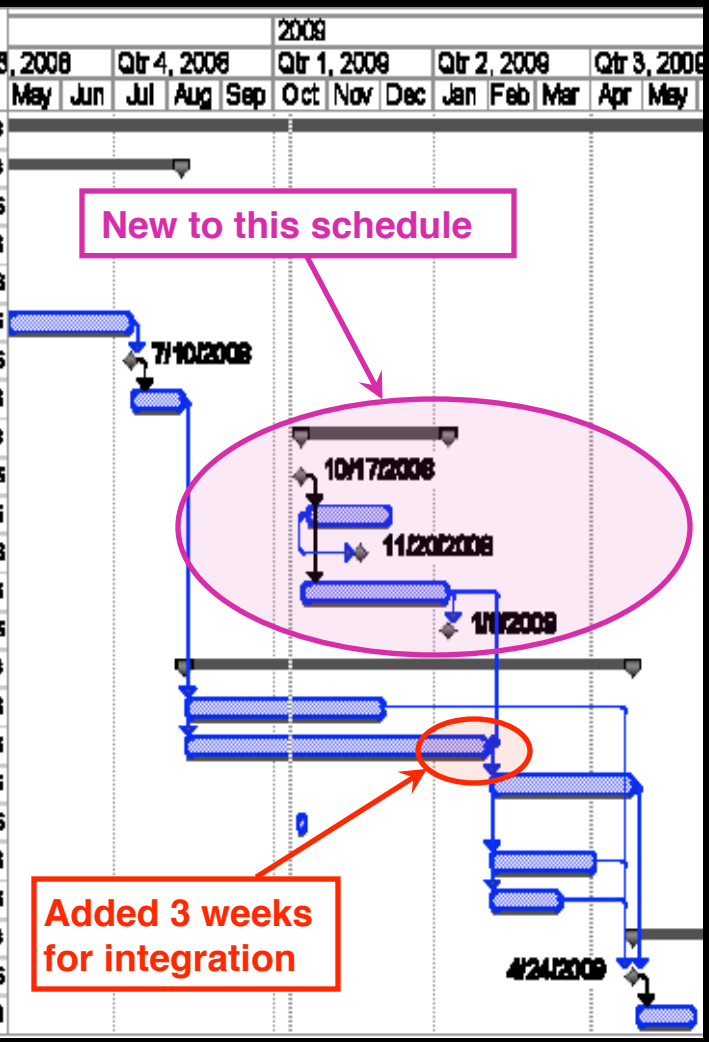
21	Level 2 PGEs	Mon 8/11/08	Fri 1/30/09	117 days
22	Iterative step-through L2 PGE	Mon 2/2/09	Fri 4/24/09	59 days
23	Science Team Meeting (Integration Status)	Tue 10/14/08	Fri 10/17/08	4 days
24	Level 3 PGEs	Mon 2/2/09	Thu 4/2/09	43 days
25	Match-Up and Cal Subset	Mon 2/2/09	Fri 3/13/09	29 days
26	**V6 Testing**	**Fri 4/24/09**	**Thu 9/3/09**	**92 days**
27	V6 Candidate Build	Fri 4/24/09	Fri 4/24/09	0 days
28	Generation of Test Products	Mon 4/27/09	Fri 5/29/09	24 days



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V6 Schedule
Test and Deliver

No changes to duration of work activities

ID	Task Name	Start	Finish	Duration
26	**V6 Testing**	**Fri 4/24/09**	**Thu 9/3/09**	**92 days**
27	V6 Candidate Build	Fri 4/24/09	Fri 4/24/09	0 days
28	Generation of Test Products	Mon 4/27/09	Fri 5/29/09	24 days
29	**PGE Testing**	**Mon 5/18/09**	**Thu 8/20/09**	**67 days**
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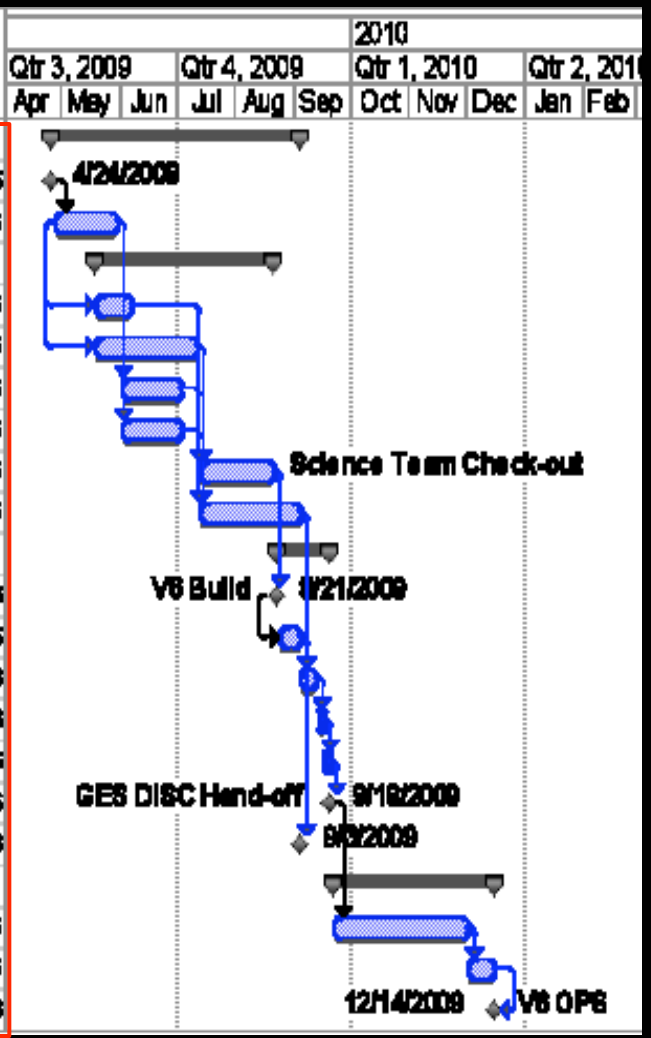

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Backup

Historical Perspective

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Historical Version V6 Schedule
April and September 2007 Science Team MTGs

ID	Task Name	2007 Start	Finish
4			
5	V6 End-to-End	Tue 10/9/07	Fri 11/13/09
6	V6 Concept and Prototype Developm	Tue 10/9/07	Fri 8/8/08
7	V6 Kickoff - Science Team Meeting	Tue 10/9/07	Fri 10/12/07
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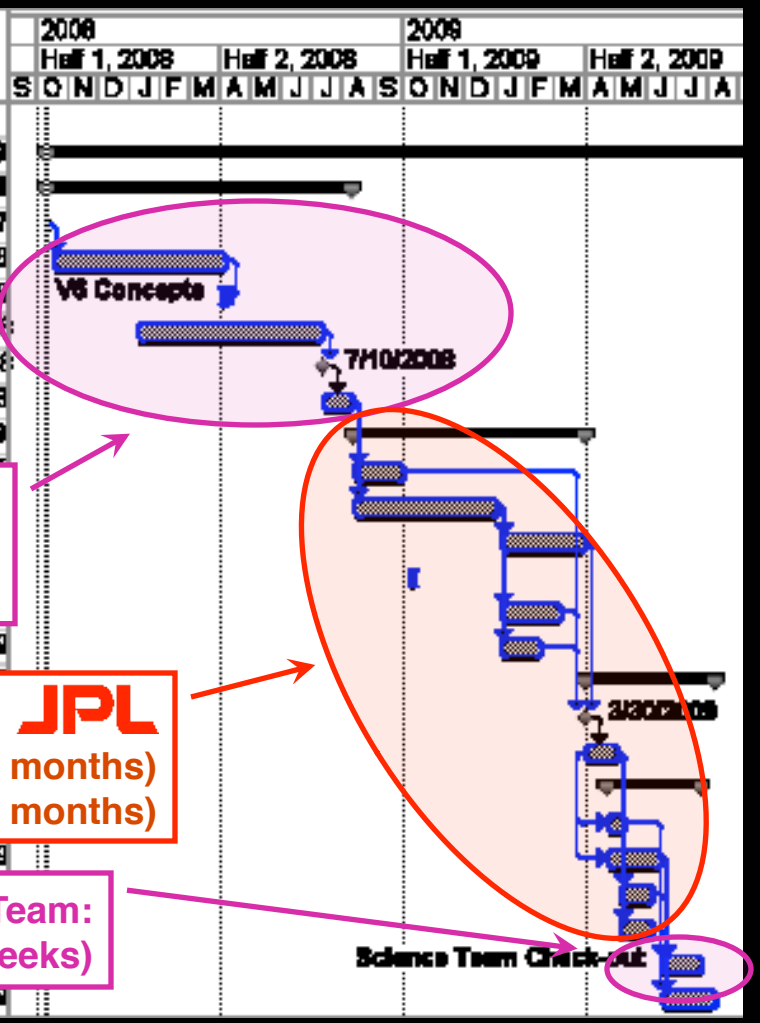
12	Issue Reconciliation	Fri 7/11/08	Fri 8/8/08
13	V6 Product Integration (JPL)	Mon 8/11/08	Mon 3/30/09
14	Level 1 P		
15	Level 2 P		
16	Iterative		
17	Science T		
18	Level 3 P		
19	Match-Up and Cal Subset	Mon 1/5/09	Fri 2/13/09
20	V6 Testing	Mo	
21	V6 Candidate Build	Mo	
22	Generation of Test Products	Tu	
23	PGE Testing	Tu	
24	Level 1	Tu	
25	Level 2	Tue 4/21/09	Fri 6/12/09
26	Level 3		
27	Match-Up and Cal Subset		
28	Science Team Check-out		
29	Documentation - all testing	Mon 6/15/09	Fri 8/7/09



Science Team: V6 Algorithms Research (6 months) and Development (6 months)

JPL Integration (7 months) and Test (3 months)

Science Team: V6 Verification (6 weeks)

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V6 Milestones

- **Schedule includes sufficient time for:**
  - Preliminary investigations / prototyping – six months
  - Total development time – greater than 1 year
  - Testing – three months

V6 Kickoff - Science Team MTG	October 2007
Concept Development and Prototyping ends	April 2008
V6 Content Determination - Science Team MTG	April 2008 ← We are here now!
V6 Algorithm Development ends	July 2008 ← Can we do it?
V6 Status - closure issues - Science Team MTG	July 2008
V6 Code Integration at JPL (CCB controlled)	August 2008 - March 2009
V6 Candidate Build	March 2009
V6 Integration and Test	April - June 2009
Science Team Verification of V6 Products	June - July 2009
V6 Delivery to GES DISC	August 2009
V6 Operational	November 2009